Developmental Research in Africa: Some Lessons

Caspar Schweigman

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Abstract

Universities in developing countries are often claimed to be engines of development: is that wishful thinking or is the claim justified? How and to which extent can scientific research contribute to development? These questions are addressed on the basis of the author's experience with research on food security. He will discuss how and to which extent research on systems analysis and mathematical modelling can contribute to the increase of food security in practice. The author focuses on the relation between theoretical and applied research, the need for theories adapted to practice and the relation between university and society. He comes to the conclusion that, and formulates some suggestions how, universities in developing countries can indeed be an engine for development.

Contents

1. Introduction[1]

In many debates on the role of institutes of higher education in developing countries it is argued that teaching and research should be oriented towards development[2]. Universities should be developmental engines.

In a historical perspective, such a mandate is not evident. The classical university was a centre for learning for the sake of learning. Even today, this classical view dictates many research programmes worldwide. A discussion[3] between Philippe Lazar, Director of a well known medical research institute in France, and Carlos Chagas, President of the Brasilian Academy of Sciences, springs to mind. The discussion dealt with the participation by developing countries in so-called *fundamental* bio-medical research, often carried out in well equipped laboratories in industrialized countries. Should the research in developing countries be limited to *applied* research? Chagas strongly defended the view that developing countries must not be excluded from any type of research, including fundamental research. If that was the case, it would really be a matter of underdevelopment. In principle, I agree with Chagas' view. On the other hand, the developing countries cannot afford the luxury to do research for the sake of research. Research is expensive. The scarce finances have to be allocated to the most effective and efficient means to help to solve the urgent problems of development, such as scarcity of drinking water and food. The questions arise whether academic research should be theoretical or applied or both; and whether the pay-off in investments in such research is high enough.

[1] An earlier version of this paper was presented at the Research Symposiumon the "Role of Research in Nation Building", organized by the University of Asmara, Eritrea, 15-18th June 2002.
[2] The former President of the Association of African Universities, Narciso Matos, has written much about the developmental university, see e.g. Matos, 2000.
[3] Quoted in Lazar, 1992, p. 16

Much research executed in the past in industrialized countries, even if it was for the sake of learning, sooner or later had a great impact on the technological and economic development of those countries. This success was not only due to the quality of the research, but also to the capability of the society, in particular the industrial sector, to absorb the research results and to implement them in practice. During a conference on research and development cooperation, E. Ganuza, chief economist for the Swedish International Development Authority, discussed[4] these issues in the perspective of Latin America. The Latin American research output had been relatively insignificant compared with the output of industrialized countries, especially in view of what might be expected given the population and gross product of the region. He analysed this gap as follows: 'In short, the active interplay between a dynamic scientific community, the productive sector, and the political society, necessary to promote and strengthen development research, is lacking in Latin America. The political and economic crisis which seriously constrains development alternatives in the continent shows no signs of easing in the near future'. So, if I want to discuss developmental research, I will not only have to deal with the nature and quality of the research, but also with the absorptive capacity of the society, and more generally, the interaction[5] between society and researchers.

Universities as engines of development: wishful thinking or justified claim? To what extent and how can scientific research contribute to development? I would like to address these questions. Of special concern will be:

a) the relation between theoretical and applied research
b) the need for theories adapted to practice

[4] See Ganuza, 1990; see also Schweigman et al., 1990, p.9

[5] At present, the interaction between academic research and society is an important discussion point in industrial countries as well. In a recent address to Dutch policymakers, captains of industry and academic researchers, Michael E. Porter of Harvard Business School, author of well known books on management and organization, was critical about the competitiveness of the Dutch economy. According to him, this competitiveness could be much improved, if the academic world and the private sector would work together more closely.

c) the interaction of researchers with society

I will not deal with development and research in general but rather limit myself to my own experience with research in Africa. In the field of development I confine myself to food security, especially in vulnerable regions in West Africa. With regard to research I limit myself to the use of systems analysis and mathematical modelling as a tool of analysis. I will start with a short introduction on food security in a historical perspective, followed by some observations on systems analysis and mathematical modelling. In the last sections I arrive at some lessons and conclusions.

2. Food security

During the Green Revolution in the 1960s and 70s high-yielding varieties of rice were developed, which were successful in East Asian countries such as India and Indonesia. These high yielding varieties required a considerable investment for improved seeds, water, fertilizers, and pesticides. The introduction of the new varieties in these countries was made possible thgrough new policies of the governments and local authorities, which created access to these inputs. In Sub-Saharan Africa the Green Revolution did not succeed. For African crops like sorghum, millet and cassave, no successful high-yielding varieties were developed. Moreover, in many African countries supply of agricultural inputs was not adequate and a proper infrastructure for agricultural research, extension services and planning was lacking. In fact, the growth of the agricultural output in sub-Saharan Africa has been stagnating during the last 25 years. During the last decade the annual cereal output per caput has even decreased.

There have been many debates about the reasons for agricultural growth stagnating in Africa. Certainly, food policies of the national governments have been of importance. During the 1970s and 1980s, the political spectrum of

regimes in Africa varied widely. Some regimes were based on Marxism-Leninism (e.g. the Dergue regime of Mengistu Haile Mariam in Ethiopia, the FRELIMO regime in Mozambique just after independence in 1975). Other regimes were inspired by variants of socialism (e.g. the African Socialism of Nyerere in Tanzania). Some countries in West Africa (such as Ivory Coast and Togo) remained under the strong influence of the former colonial power (France). Independent of the colour of the regimes, the governments in almost all African countries appropriated a central role in the field of food policies. Food policies referred to a wide range of issues; governments would, for example, control the production of farmers by imposing collective production systems, or they would adopt policies to control markets and prices. The first type of policies was only applied by a few regimes, e.g. in Ethiopia and Tanzania. Other policies were adopted by many countries. Governments were often an actor on the food market and imposed official prices. National marketing boards were installed, which bought from the farmers and sold via intermediaries to consumers, usually at fixed producer and consumer prices. These centrally governed policies were defended by claiming that private traders would ask excessive prices and would endanger food security of poor households. In most African countries these large organisations were not successful. There were great problems of managing them: farmers were not always paid on time, transport was delayed etc. Also national policies of official prices were not always successful. They had detrimental effects as well. Since consumer prices were set at a low level and all levies had to be paid to the state controlled intermediaries, the farmers often received low prices. This discouraged farmers to invest in improved technology in order to increase production levels. The terms of trade of the agricultural sector deteriorated. In fact, the alleged market failures were replaced by government failures[6].

[6] See e.g. Lutz et al., 1999.

In the eighties and nineties the ideas on the role of the state and on the relation between the public and private sectors changed. By accepting the Structural Adjustment Programmes[7], recommended or rather imposed by IMF and World Bank, the role of the state was severely reduced in most developing countries: markets were privatized, marketing boards abolished, most prices were no longer fixed by the government, import restrictions abolished, etc. Nowadays it is often argued that a private market is the best way to boost the economy and a private food market the best way to attain food security. The role of national governments should be restricted to create conditions for an optimal functioning of the private market (infrastructure, transparent rules and regulations etc.), to keep a food safety stock as a reserve to anticipate failing harvests and to organize food aid. To what extent the private market can indeed contribute to food security, is one of the crucial questions for the next decades: in many vulnerable regions in Africa the environmental conditions for agricultural production are deteriorating, possibilities of off-farm employment are limited and the purchasing power of the local population is low; traders may not be interested to buy or sell in these regions and the effect of privatization on food security is not at all evident.

Many farmers and their families in Sub-Saharan Africa are peasant smallholders, who try to be self-reliant in food production. The area to be cultivated by the farmers' household hinges on the availability of land and labour. How much and which land is available for cultivation usually depends on locally prevailing systems of land rights. According to these systems farmers do not own the land, they have only the usufructuary right to cultivate it. When land-use rights are very insecure, this may prevent the farmer from investing in soil management. At the Central Plateau of Burkina Faso, for instance, the land-

[7] a large number of developing countries accepted the Structural Adjustment Porgrammes in order to be able to obtain loans by the Bretton Wood institutions under favourable conditions.

use rights are particularly insecure for young farm-households, for 'immigrated' farmers, for pastoralists who have settled down at the border of a village, and for women within the farm-household. Systems of land-use rights are sometimes very complex.

In traditional agricultural systems the same piece of land is not cultivated permanently. After years of cultivation it is left fallow during a certain number of years to restore soil fertility. The longer the fallow period, the less land is available for cultivation. In many vulnerable regions in West Africa demographic growth has caused a shortening of fallow periods, resulting in a shift towards a system of (semi-) permanent cultivation. In such situations sustainable food production can only be safeguarded if farmers intensify agricultural production and apply proper methods to restore soil fertility.

Intensification of agriculture is usually associated with the use of external inputs like chemical fertilizers. However, intensification may also refer to the application of local methods of soil and water management like the re-use of crop residues as organic matter, the collection of manure, the integration of livestock and agriculture, the construction of rock bunds[8] or traditional techniques like the *zai*[9]. In many vulnerable regions in West Africa, farmers can not afford to apply chemical fertilizers for their food production, since they have no easy access to the fertilizer market or because farmgate prices are high. Therefore, at least for the short term, improving methods of sustainable food production will only be realistic, if use is made of low levels of external inputs: local methods of water and soil management have to be combined with attuned application of low doses of external inputs.

[8] Constructed to slow down water run-off, to improve the infiltration in the soil and to reduce erosion, see e.g. Reij 1983, Reij et al. 1996, Maatman et al. 1998.

[9] A traditional technique in West Africa: a hole is dug, organic manure is placed inside and seeds are sown. The method is very labour intensive, the labour for digging and application of manure is carried out before the raining season starts. See Kaboré et al., 1994, Maatman et al., 1998.

At the micro- level two features deserve special attention: the way farmers cope with *risk* and local *co-operative* initiatives. Farmers' strategies to cope with risks due to uncertain rainfall and to low and variable yield levels refer to measures[10] of:

- prevention of risks
- dispersion of risks (by diversification of risky activities)
- control of risks through sequential decision making
- 'insurance' against risks.

The above mentioned soil and water management methods may be considered risk prevention strategies. Methods of risk dispersion refer, for instance, to the cultivation of different local varieties, different systems of mixed cropping, and to early and late planting. Methods of risk control may refer to sequential decisions of sowing and re-sowing, to intensive or less intensive weeding depending on the observed rainfall pattern and the growth of the plants. 'Insurance' methods may refer to keeping livestock as 'insurance' against a poor harvest or - if that is possible - installation of a safe stock of cereals at the end of the year. In most farming systems in West Africa these risk strategies are all important elements of the farmers' strategies. A proper analysis of farmers' strategies and food security perspectives has to take these different risk strategies into account.

During the last two decades a growing number of farmers in West Africa have taken collective initiatives to improve their situation. Examples are village co-operatives in which farmers work together on anti-erosion methods, like the construction of rock bunds, on the introduction of *zaï* on communal fields, and the construction of small water reservoirs. *Cereal banks* are also examples of co-operative initiatives: at the village level, reserve grain stocks are built up to strengthen food security and to improve the system of distribution. Cereal banks have been introduced on a large scale. Since a couple of years a revival of co-operative movements can be observed, which try to strengthen the farmers'

[10] See Maatman, 2000, p. 393.

position vis à vis the market, to facilitate the purchase of inputs and the sales of outputs, to save money and to get easier access to credits. These co-operative organisations to strengthen the farmers' position in a more competitive environment may be a reaction to the process of privatization, due to the introduction of "structural adjustment programmes".

3. Systems Approach and Mathematical Modelling

Food security issues as discussed above are complex phenomena. They can be studied at several levels, for instance at the macro-, meso- and micro-level. At each level various actors may be involved. Climatic, environmental, economic, and social factors play a role. They may be strongly interrelated. A *systems approach* allows for a proper analysis of such complex phenomena. It considers an organism or organisation as a system[11], which consists of constituent elements. Between these elements relations exist. If the system is closed, no relations with the external world exist, in an open system such relations do exist. In a system various sub-systems may be distinguished. Each system has its specific characteristics, both in terms of its constituent elements and the mutual relations. The holistic systems approach explores how changes in one constituent element may change the other elements in the system. If we would like to make an analysis of farmers' strategies in a representative household in West Africa, this household and its strategies could be considered as a system. The constituent elements may consist of the members of the household as *actors*, crop and livestock production as *activities*, land and labour as *physical and human resources*, fertilizers as *inputs* to be bought and harvested produce as *outputs* to be sold or consumed. Between these elements *relations* exist. An

[11] See e.g. Garcia, 1984; Fresco, 1986; Schweigman 1986a; Luning, 1991; van Duivenboden, 1995; Maatman et al. 1996, Ch. 3; Maatman 2000, Ch. 5.

illustration of such a system and various elements is presented in Figs.1 and 2 in the appendix to this paper.

A systems approach requires an accurate description of concepts to be used. A distinction can be made between a *descriptive* and a *normative* analysis of farmers' strategies. In a *descriptive* analysis empirical questions are addressed. Examples are: what is the social organisation, what was the reason of emigration, what is the method of storage etc. Many field studies focus on empirical questions. A descriptive analysis often refers to both the past and present. A *normative* analysis investigates which strategies do well under various conditions and how they can be improved. A normative analysis refers to the present and the future. In a normative analysis of farmers' strategies, *normative questions* or *decision questions* play an important role. Examples of decision questions are: should a member of the family emigrate, should a loan be taken up, if yes, how much; when should the farmers sow? In a normative analysis it has to be examined which decision questions are relevant and therefore have to be taken into account, and which factors influence the decision questions. Is their influence direct or indirect? A useful distinction can be made between *exogenous* and *endogenous* factors. On the *exogenous* factors the decisions of the farmers have no influence. In a study of farmers' strategies a systems approach helps to disentangle factors influencing farmers' decisions and to clarify their interrelationships.

The systems approach can be the basis for mathematical models which simulate farmers' strategies. I refer here in particular to a normative analysis. If in such an analysis all actors, activities, resources, inputs and outputs have been well identified and all decision questions of importance accurately formulated, then a mathematical model (e.g. linear programming models) can be established, which helps to analyse how and to which extent the various factors influence the farmers' decisions and which improved strategies are feasible and good ones.

Usually, the decision questions of the systems approach are incorporated as *decision variables* in the models and most exogenous factors as *parameters* in the model. Labour and land constraints may reflect the availability of resources. Other constraints may refer to fallow practices, required consumption patterns, possible access to credits, market conditions etc. Various ways of coping with risks can also be addressed. The balance of conflicting targets can be investigated, for example the balance between keeping safety stocks of food versus selling as much as possible. Different interests within the household, for instance of husband and wives, can also be balanced. With the aid of such models "optimal" strategies can be simulated.

The building of such models is a step-by-step process. Usually a base model is first set up, which describes farmers' strategies in practice 'reasonably well'. The development of the model is an interactive process between researchers, local experts, farmers' organisations and farmers. Once such a model for existing strategies has been constructed and verified, it can be used as a tool to study new strategies.

The use of mathematical models has often been criticized by social and political scientists, who are very aware that many development problems depend on power relations, social organization and human factors, which cannot be framed in mathematical models. In order to respond to such criticism, permit me to quote what I have said about it in an earlier paper. "Many development problems are very complicated, since all factors of importance are strongly interrelated. It is very difficult, if not impossible to deal with these interrelationships. With the aid of mathematical modelling many of these factors can be studied in their coherence indeed. Moreover, the influence of the change of conditions can be explored without the immediate necessity to carry out new field studies or experiments. The weakness of mathematical models, namely that

they are only simplifications, is their strength as well. The structure of the model can be well understood, hypotheses and assumptions are well defined. For that reason it can structure the discussions and the understanding of the issues considerably. Each scientific analysis of complex situations is based on simplifications, each research approach on mental "models' and perceptions. The contribution of mathematical modelling to solve problems can only be modest like the contribution of other scientific disciplines. Its contribution can be important though, if the modelling activities are integrated in an interdisciplinary approach. In interaction between farmers, policy makers on local level and researchers." I will discuss this interaction in the next section.

4. Food security research: from transfer of technology to interactive learning

The academic research discussed in the previous section aims at the development of integrated knowledge about food security in a farmers' context. The study of possible innovations to be adopted by the farmers is an integral part of it. Thirty years ago such an approach was unthinkable. In those days[12] the key word was 'transfer of technology'. In research centres highly trained specialists developed new technologies. After successful trials at these centres, the innovations were transferred to the farmers. In technologically advanced countries such a transfer was successful. Not in Africa. There it was increasingly realized that the farmers' conditions should be taken as a starting point. 'Farmers first' became the key word. Farmers were consulted, and subsequently innovative projects were carried out jointly by farmers and agricultural

[12] For a survey of changes in approaches of the introduction of innovative agricultural technologies in developing countries, see Bunders, 2001. See also Scoones et al., 1993, and Cornwall et al. 1993.

researchers. *Interactive learning*[13] became the leading principle. This changing attitude from transfer of technology to interactive learning had a great impact on research agenda's and even on the composition of the staff of agricultural research institutes. In Burkina Faso, for instance, in the early 1980s the first economists and sociologists joined the national agricultural research institute INERA[14], formerly a bastion of agronomists and zoologists. In 1985 INERA created a special Programme on Research on Production Systems (RSP), complementary to the existing thematic technical programmes. As part of the RSP programme interdisciplinary research teams were established in various regions of the country. The new programme distinguished itself from the classical agricultural research programme by various features: the perception that a rural household was to be considered as a system with its actors, activities and resources; orientation to solving the problems of small scale peasants; execution of field tests at a farm level with increased participation by the farmers; and an interdisciplinary approach[15].

Most food security problems are of an *interdisciplinary* nature. I participated in several international research projects on food security in Burkina Faso, where an interdisciplinary approach was adopted. Many disciplines were represented: social sciences, agronomy, soil sciences, meteorology, economics, operations research and statistics. Interdisciplinary research was indeed structured by a systems approach[16]. The intensive discussions about the contents of the project's joint approach, have been one of the challenging and useful experiences of these projects. The interdisciplinary efforts and the findings of individual research have resulted in a collective outline of themes of priority within these projects. There is good reason to give a warning as well: interdisciplinary collaboration is

[13] See Bunders, 2001, p. 28-30.
[14] Institut National de l' Environnement et de Recherches Agricoles.
[15] For a brief history of "agricultural research" in Burkina Faso, see e.g. Maatman, 2000, Chapter 4.
[16] See e.g. Schweigman, 1986; Maatman et al., 2000.

difficult and requires a lot of discipline. The core of the research team should be very experienced. A gradual step-by-step building up of interdisciplinary programmes is advisable. In some of the projects referred to above a co-operation was established between academic researchers and researchers working closely together with farmers' communities in several villages.

Interdisciplinary research based on interactive learning, which includes an exchange of experiences between rural communities, policy makers and researchers, can only be a long-term enterprise. Mutual understanding has to grow, experience to be built up, continuity safeguarded. It requires a strong commitment and management.

5. Interaction between university and society

Where can in such a context academic teaching and research best be situated? It could be argued that the universities should restrict themselves to training in the academic disciplines, a task which is difficult enough. It is true that the primary focus of university training should be on the individual disciplines, such as economics, agronomy, sociology, mathematics etc. Nevertheless, if any intention exists to make academic training and research "development related", then in one or another way an integration of the discipline into an analysis of real life problems of development will be necessary. I am not referring to new ambitious interdisciplinary teaching and research programmes. On the contrary. I would like to refer to the following modest but important activities:

(a) The inclusion of examples in class. During my four-year stay as a teacher at the University of Dar es Salaam, in Tanzania, students and I worked out case studies of farming systems in the students' home villages and discussed them in the courses on Operations Research at the Mathematics Department. It was

a challenging experience for both the students and the teacher. Such an initiative is no longer an exception. Nowadays, in many courses taught at universities local case studies in various fields are discussed in class.

(b) Promoting case studies to be worked out by students for certain courses or their Masters' thesis. The case studies could be linked to situations in practice and combined with internships. The effectiveness of such case studies increases tremendously, if they are imbedded in a coherent research programme. The Economics Faculty of the University of Ouagadougou has a programme on co-operatives in Burkina Faso. A great number of students are involved in writing monographs on different co-operatives in different regions of the country. The results of such studies can be a rich source of information and experience. In Benin similar studies are carried out on various micro-credit systems in the country.

(c) Mutual co-operation between university researchers. It is a pity that in some universities in developing countries researchers of the same faculty or of different faculties do not work closely together. Any ambition to work on joint development programmes depends on the willingness to co-operate. This can not be imposed by installing joint working groups or committees, but has to be based on academic interest. Useful initiatives could be joint supervision of a student, or commenting on a colleague's paper.

(d) Dialogue between researchers and policymakers[17]. Many national and international development programmes emphasize such a dialogue. It is believed that without such a dialogue research results can not be implemented. The nature of the dialogue is, however, not always well understood. Researchers, who develop mathematical models as discussed in the previous section, often claim that such models are tools for policy makers. Policymakers could use these instruments to solve their practical problems. This is much too ambitious. Usually, the models are only

instruments for the researcher to structure his analysis. In transferring his findings to policy makers and the public he faces the same problems as all academics. The results have to be presented in an accessible language[18]. The dialogue between researchers and policy makers can be facilitated by the organisation of seminars and workshops, where problems are discussed between researchers and interested policy makers. I recall a recently held workshop in Can Tho in Vietnam, where both university researchers and representatives of ministries, state owned food companies and private rice traders discussed the functioning of the rice market in Vietnam. It was one of the most stimulating discussions about such issues I ever attended. The workshop was organized to present the progress of PhD research. Committed policy makers at various levels could also be involved in the setting up and monitoring of academic research activities.

(e) Relations between university researchers and stakeholders in the field. The processes of interactive learning can take place in various ways, through collaboration of university researchers with national research institutes, local governmental and non-governmental organisations, farmers' organisations and farmers themselves. Field visits may be required, and stakeholders could participate in the establishment[19] of research projects.

[17] For a critical review why the interaction between researchers and policymakers is weak, see e.g. Baud, 2002.
[18] Van der Horst, 2002, wrote a challenging paper on the communication between academic scholars and stakeholders in society.
[19] There are many examples of farmers and farmers' representatives participating in the set up of research projects. Reij et al. mention how in a research project in Cameroon research priorities were set by two farmers in two villages, who had very clear ideas about inn ovations, see Reij et al., 2000, p. 51. See also Musch, 2001, about farmers participating in the set up and progress of irrigation projects.

6. Conclusions

I have tried to show under what conditions academic research can be helpful to solve certain problems of development, in particular problems related to food security. It is a long term process. I arrive at the following conclusions:

a) Many problems of development are so complex that academic research is required to analyse them properly. For such an analysis theoretical methods are a necessity.
b) These theoretical methods have to be adapted to the specific local conditions. Suggestions that a proper analysis of important problems of development can be made by applying certain techniques without a thorough reflection on the concepts and methodology to be used are wrong.
c) To a large extent, the perspective that scientific research can indeed contribute to solving development problems depends on the capability and willingness to collaborate with target groups and policy makers at various levels. This can only be achieved by means of long term joint efforts.

My main conclusion is that universities can indeed be engines for development. Referring to the discussion between Lazar and Chagas mentioned in the introduction, I would like to comment on the innovative nature of development-related research. Even if universities in developing countries concentrate a great deal of their research on development issues, they can also be an engine of high quality innovative research, and theoretical research. I refer to an example of required theoretical research. As was discussed earlier, in West Africa co-operatives are widespread. Some do very well, others fail due to misconceptions, financial problems, mismanagement etc. There is a conspicuous lack of insight on why, on the one hand, the co-operative phenomenon has developed so much in West Africa during the last years and why, on the other hand, so many

initiatives have failed. There is also a large gap between the theories about co-operatives and the practical evidence. There are economic theories, which claim that co-operatives cannot be economically efficient. This seems to contradict the existence of co-operative movements in practice. The correctness of the theoretical claims all depend on the propositions made and conditions assumed. It can easily be shown, both theoretically and in practice, that under certain conditions some specific co-operative activities can be efficient. There is a need to develop theoretical frameworks to understand these phenomena.

One of the most challenging fields where innovative theories have to be developed is the role of the state and the market. It was seen in previous sections how during the last years the role of the public sector has changed. Nowadays, it is widely understood that food security has to be ensured in a free market. It is not certain, however, whether that can be attained in all situations. An enormous gap exists between economic theories at the macro- and micro-level. Existing economic theories about markets have to be modified to fully understand market mechanisms, the possible role of the public sector and the perspectives of farmers at the micro-level, who may face the daily problems of depletion of soils, no access to chemical fertilizers and other inputs and a lack of off-farm job opportunities. Such modified theories are required to design viable policies of development. If young PhD researchers in developing countries will help to develop such modified theories, the pay-off of the investment in their PhD research will be quite high.

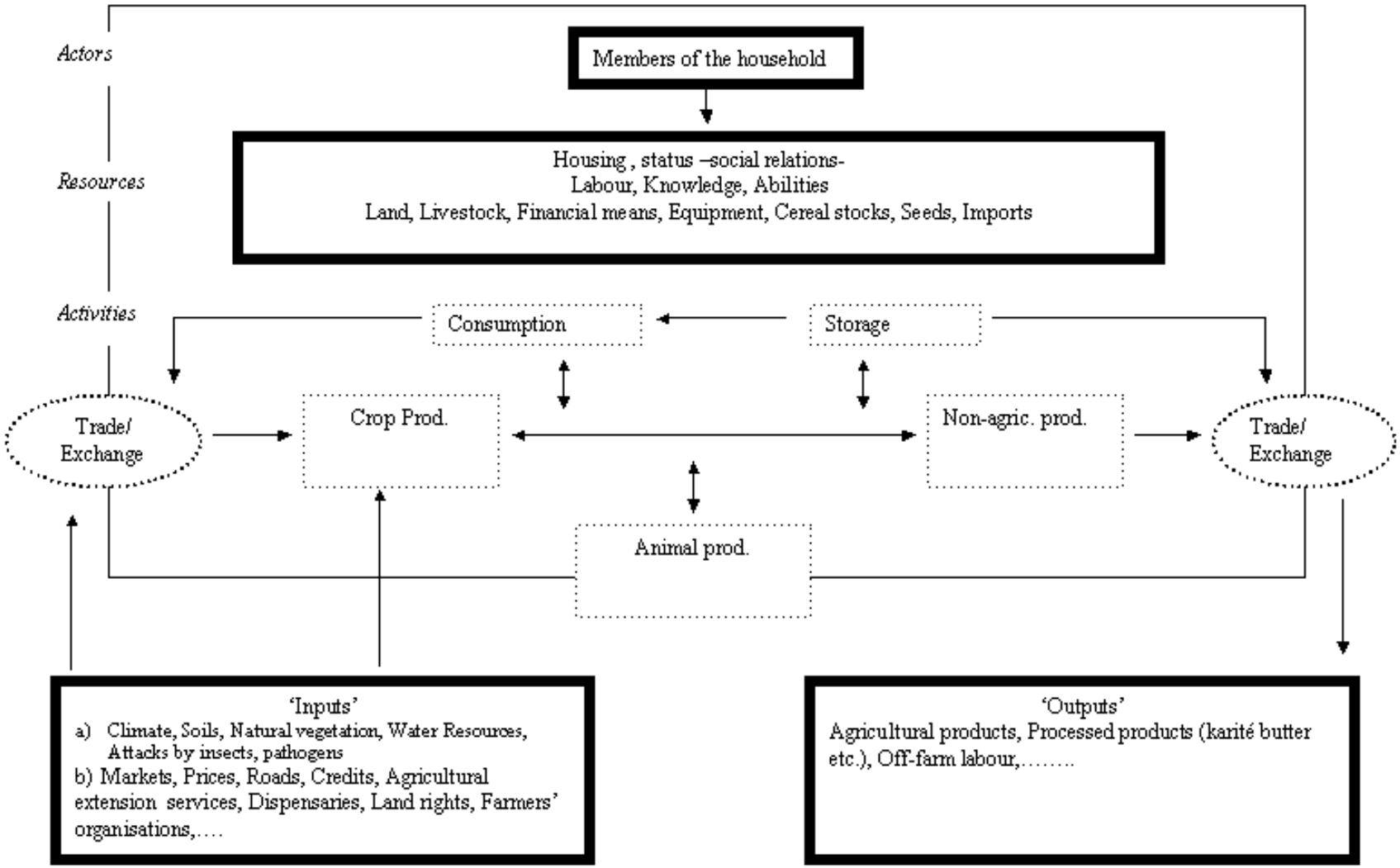

Figure 1: Illustration of a system of a rural household (adapted from Maatman, 2000)

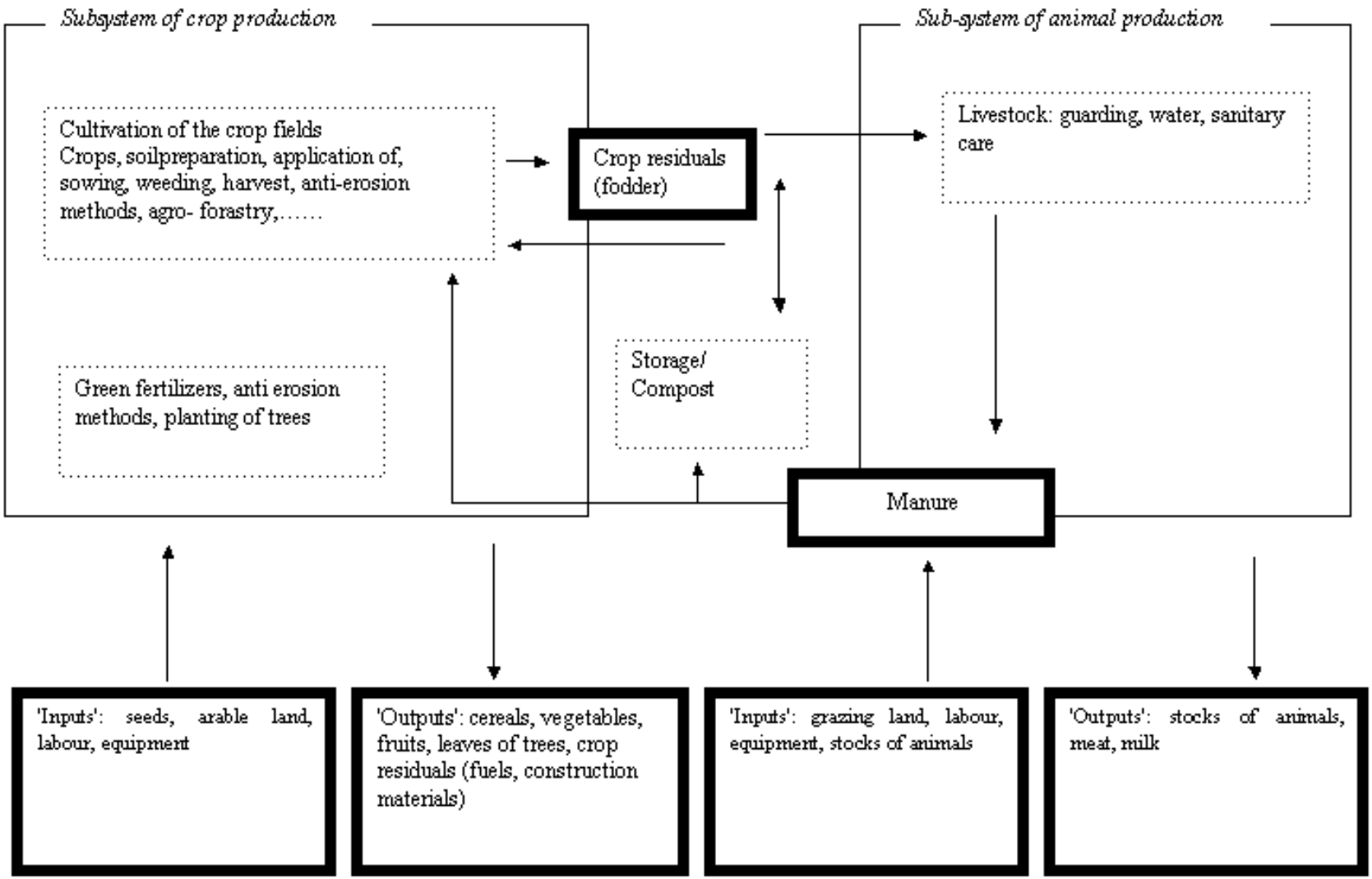

Figure 2: Subsystems of crop and animal production and their interrelations (adapted from Maatman, 2000).

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